19. City of Tucson

The City of Tucson is Arizona's oldest city with a unique blend of Indian, Spanish, Mexican and Anglo heritages. The city is the second largest in the state and is also the Pima County seat. Tucson is a modern city with high-tech industries and world-class cultural events, yet it retains the charm of its desert frontier roots. The main components of Tucson's employment base include the government service sector (i.e., Federal, State and local governments) and the University of Arizona. Manufacturing also plays a major role in the economy, as manufacturing employment has more than doubled in the last 10 years. The Tucson MPA is located throughout the greater Tucson area and includes large areas south and west of downtown Tucson.

According to the ADWR Annual Water Withdrawal and Use Report, in the City of Tucson in 1998, 83,766 af of groundwater were pumped and delivered. In addition, 27,490 af of groundwater were from other sources and 202 af of CAP water were received. From the total 111,459 af of water received, 455 af were delivered to other users. The remaining 111,004 af were delivered for use within the City of Tucson.

A. Plans to Take and Use CAP Water

The City of Tucson currently has a subcontract for 138,920 af of CAP water. In 1983, Tucson received an allocation of 151,064 af, 2,644 af of that allocation were transferred to Ranch Lands (then Spanish Trails) before the contract was offered. Also, 642 af were transferred to Oro Valley and 8,858 af were transferred to MDWID. Under the Settlement Alternative, the City of Tucson would receive an additional 8,206 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-111 outlines the proposed CAP allocation by alternative.

Table L-M&I-111
CAP Allocation Draft EIS
City of Tucson– Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	8,206	M&I
No Action	0	--
Non-Settlement Alternative 1	8,206	M&I
Non-Settlement Alternative 2	0	--
Non-Settlement Alternative 3A	0	--
Non-Settlement Alternative 3B	8,977	NIA
Existing CAP Allocation	138,920	--

Figure L-M&I-56 shows the service area and MPA for the City of Tucson. The MPA covers approximately 779,846 acres. The City of Tucson's plans to take and use CAP water are constrained by Proposition 200 Water Consumer Protection Act (WCPA), which passed in 1995 and restricts direct deliveries of CAP water. Currently, Tucson is participating in several recharge facilities including the Central Avra Valley Storage and Recovery Project (CAVSRP), the Pima Mine Road Recharge Facility, and indirect facilities (CMID, Bing K. Wong Farms, and Kai Farms). The City of Tucson constructed the CAP Treatment plant, which has a capacity of 168,300 afa; however the WCPA precludes the use of this treatment plant.

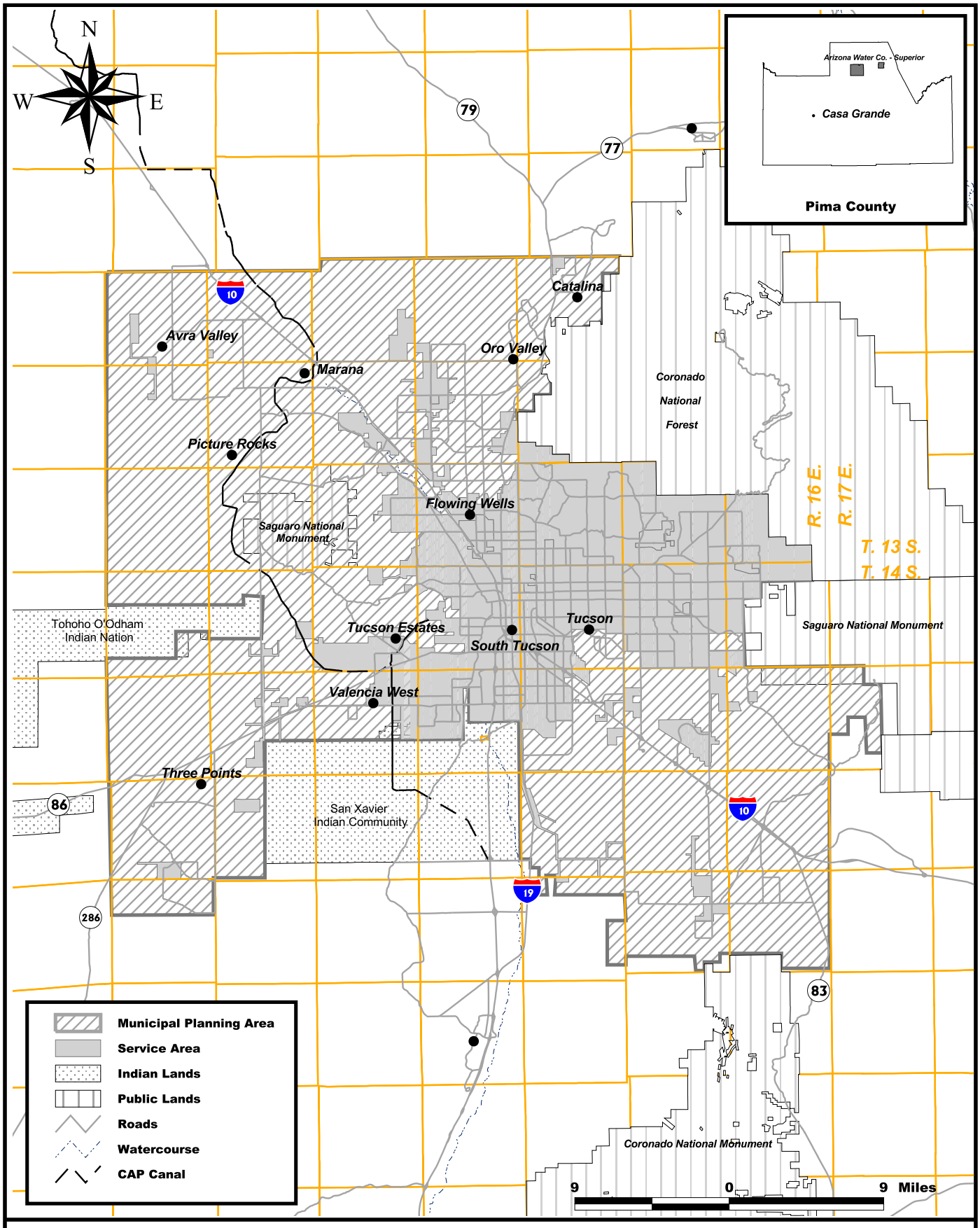
The City of Tucson is using an increasing amount of its CAP allocation for recharge and recovery as a short-term solution. Tucson has not determined how it would ultimately use its full allotment in the long term. Tucson continues to explore options for direct delivery, including a recent pilot study in cooperation with Reclamation on membrane filtration. In November 1999, voters defeated a proposition, which would have increased restrictions on CAP water use originally established by the WCPA. The majority of the restrictions from the 1995 Act would expire in November 2000. The CAVSRP, currently under construction (recharge basins and recovery facilities, wells and pipeline), would begin delivery of CAP water in early 2001 (Johnson 2000).

B. Population Projection

The population in the City of Tucson in 1985 was 531,230. The estimated 2001 population is 644,223, and the estimated 2051 population level is 1,128,535.

C. Water Demand and Supply Quantities

As previously shown in Appendix C – M&I Sector Water Uses, it is estimated that water demand in the City of Tucson would increase from 110,415af in year 2001 to 193,423af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-112. Based on anticipated water demands, water which would be allocated under the Settlement Alternative, would provide seven percent and four percent of the current estimated water supply required for the City of Tucson for the years 2001 and 2051, respectively.



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CAP Allocation Draft EIS
General Location Map
City of Tucson

June 2000

Figure #L-M&I-56

Table L-M&I-112
CAP Allocation Draft EIS
City of Tucson– Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	0	147,126	110,415	44,733	0	0	0	1,564	110,415	193,423
No Action	0	138,920	110,415	44,733	0	0	0	9,770	110,415	193,423
Non-Settlement Alternative 1	0	147,126	110,415	44,733	0	0	0	1,564	110,415	193,423
Non-Settlement Alternative 2	0	138,920	110,415	44,733	0	0	0	9,770	110,415	193,423
Non-Settlement Alternative 3A	0	138,920	110,415	44,733	0	0	0	9,770	110,415	193,423
Non-Settlement Alternative 3B	0	147,126	110,415	44,733	0	0	0	1,564	110,415	193,423

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 193,423 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 8,206 afa of demand are met by the additional CAP allocation. Alternatively, this 8,206 afa of demand are met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

Land use data for the City of Tucson were obtained based upon the review of 1998 aerial photographs and the result of the field surveys and habitat mapping completed as part of the biological analysis in this EIS. Table L-M&I-113 provides the projected acres of land within the City of Tucson MPA that are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

Table L-M&I-113
CAP Allocation Draft EIS
City of Tucson – Projected Land Use Changes Within the MPA (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes in Urban Acreage
Settlement Alternative	2001	11,000	--	535,313	--	233,533	--
	2051	4,464	6,536	486,859	48,454	288,523	54,990
No Action	2001	11,000	--	535,313	--	233,533	--
	2051	4,464	6,536	486,859	48,454	288,523	54,990
Non-Settlement Alternative 1	2001	11,000	--	535,313	--	233,533	--
	2051	4,464	6,536	486,859	48,454	288,523	54,990
Non-Settlement Alternative 2	2001	11,000	--	535,313	--	233,533	--
	2051	4,464	6,536	486,859	48,454	288,523	54,990
Non-Settlement Alternative 3A	2001	11,000	--	535,313	--	233,533	--
	2051	4,464	6,536	486,859	48,454	288,523	54,990
Non-Settlement Alternative 3B	2001	11,000	--	535,313	--	233,533	--
	2051	4,464	6,536	486,859	48,454	288,523	54,990

2. Archaeological Resources

Both linear (e.g., Hammack 1983; Rieder and Myers 1996; Slawson 1993; Stephen 1988) and block (e.g., Rozen 1985; Simpson and Wells 1984; Slawson 1994) surveys have yielded sites within this entity's boundaries. Areas of high and moderate cultural resource sensitivity are located primarily at lower elevations along the area's major drainages (e.g., the Santa Cruz Riverpark Archaeological District, a National Register property). Known prehistoric resource types include numerous aceramic artifact and fire-cracked rock concentrations of possible Archaic affiliation, as well as Hohokam sites ranging from small sherd and lithic scatters, to extensive agricultural systems (e.g., AZ BB:14:32(ASM)), to large villages with multiple house clusters, (e.g., the West Branch site, the Valencia Site, Julian Wash, St. Mary's, Punta de Agua, Los Morteros). At higher elevations, camp sites, trails, petroglyphs, and resource procurement and processing sites are common. Although no sites have been reported in the southwesternmost portion of this entity, this area borders the Gunsight Mountain Archaeological District, a National Register property which includes more than 40 sites; similar site types might be expected. Likewise, areas of low cultural resource sensitivity in the east and northeast portions of the entity are surrounded by areas of high site density (e.g., the Saguaro Wilderness area, Colossal Cave County Park, the Sutherland Wash Archaeological District, and the Rincon Foothills Archaeological District, all National Register properties). Protohistoric Pima, Papago, and Yaqui sites also are known; the entity's proximity to the Tohono O'odham (TON) and Pascua Yaqui Reservations suggests similar sites might be expected to occur in unsurveyed areas.

Historic resources include properties from the area's early Native American, Spanish, Mexican, and Anglo occupations (e.g., San Xavier Mission, Agua Caliente Ranch) and represent every identified historic context, including farming, ranching, mining, commerce, and transportation. The nature of the depositional environment, particularly along the Santa Cruz River floodplain and lower terraces, indicates the potential for buried cultural deposits is high; finds in the nearby Schuk Toak Archaeological District include paleontological remains dating to the Pleistocene, raising the possibility that Paleoindian sites might be present within the entity.

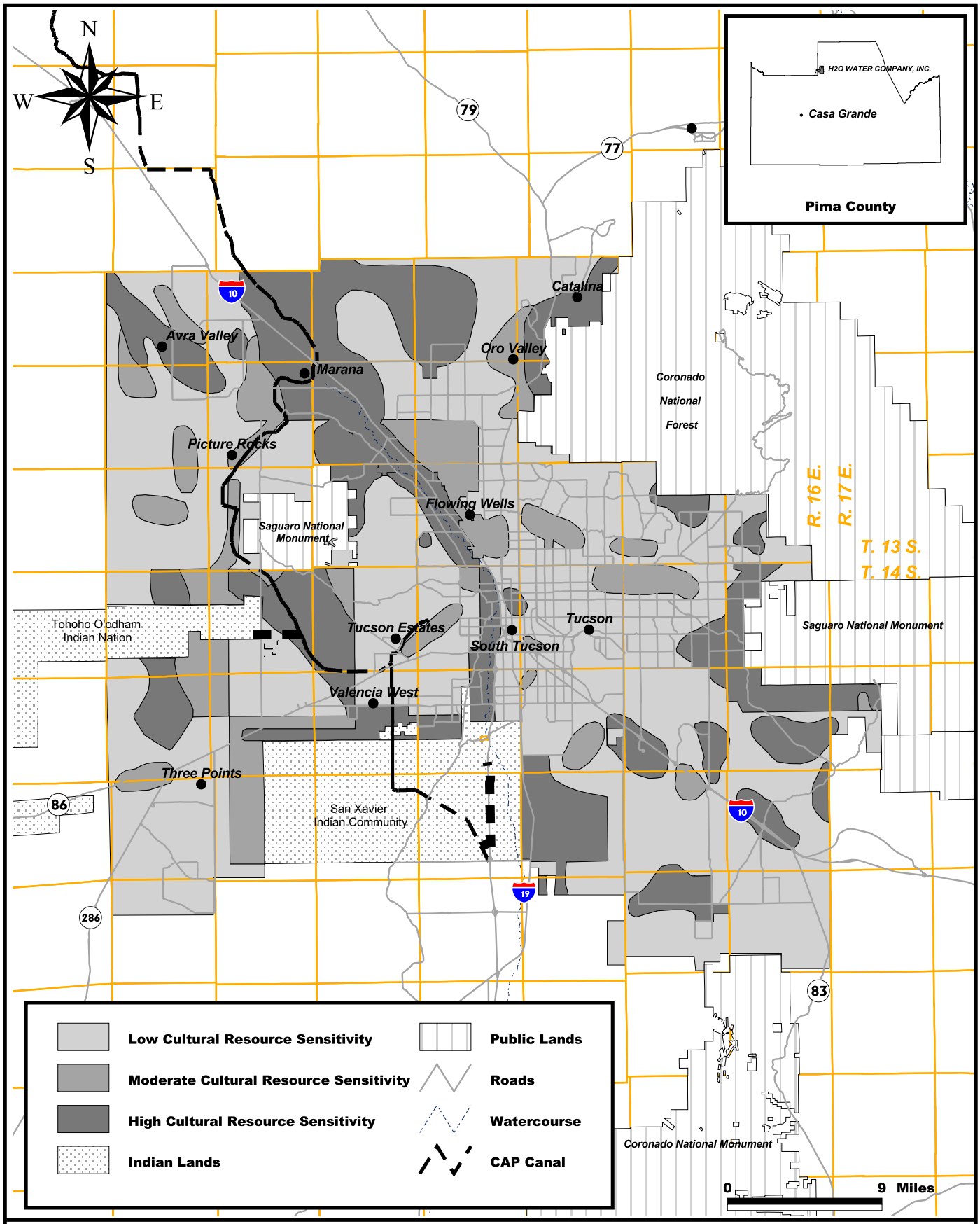
Cultural resource sensitivity areas in this entity are shown in Figure L-M&I-57. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is high to moderate. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. It does not appear that Tucson would require additional CAP delivery or treatment facilities to handle the additional allocation. Thus no additional impacts to cultural resources are expected from the construction of such facilities. However, Tucson's long-term plans are uncertain, as described above. Once Tucson determines its final plans for taking the additional CAP allocation, Reclamation would determine whether additional cultural resource compliance is required.

3. Biological Resources

Existing Habitats

The large area within the boundaries of the City of Tucson MPA includes portions of the Tortolita Mountains (to 4,000-foot elevation) and the Tucson Mountains. Alluvial fans spread outward from rocky ridges and hillsides and onto silty plains. Jojoba/Mixed Scrub Association occurs on steeper slopes and varies greatly in its composition of species. Overall it is dominated by wormwood, slender janusia, jojoba, bedstraw, and Wright's lippia. Trees include blue-paloverde, foothill paloverde, and velvet mesquite. Saguaro density varies from sparse on north-facing slopes to dense on south-facing slopes.

Bursage/Foothill Paloverde Association occurs on more gentle slopes and represents most of the natural habitat recorded for the City of Tucson MPA. Co-dominants include creosote-bush, buckhorn cholla, brown-spined prickly pear, chain-fruit cholla, and Engelmann prickly pear. Other common trees include blue-paloverde, desert ironwood, and velvet mesquite. For the most part, the density of saguaros is high. Creosote-Bush Association composes a large portion of the silty alluvial soils. The frequency of creosote-bush is very high with co-dominants including bursage, burrobush, and whitestem paperflower. Trees present are foothill paloverde, desert ironwood and velvet mesquite. The density of saguaros is low. Disclimax Grassland Association occurs mainly in the



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CAP Allocation Draft EIS
Cultural Resources
City of Tucson

June 2000

Figure #L-M&I-57

southeastern portion of the planning area and is dominated by brown-spined prickly pear and several grass species. Co-dominants include velvet mesquite, soaptree yucca, whitestem paperflower, chain-fruit cholla, white-thorn acacia, and buckhorn cholla. Blue-paloverde and foothill paloverde are also present. Saguaro density is low. Velvet Mesquite Association occurs along broad drainages and within some flood plains where the frequency of velvet mesquite is very high. Co-dominants are Fremont wolfberry and creosote-bush. Saguaro density is low. The habitat zones are shown on Figure L-M&I-58. Table L-M&I-114 provides the habitat acreages for the habitat zones described above.

TableL-M&I-114
CAP Allocation Draft EIS
City of Tucson MPA– Habitat Acreages

Vegetation Name	Acres
Developed	244,533
Bursage / Foothills Paloverde	213,308
Velvet Mesquite	20,250
Jojoba / Mixed Scrub	14,466
Scoured, Washes, and Creeks	11,306
Creosote-Bush	207,314
Snakeweed / Velvet Mesquite	68,669
Total	**779,846**

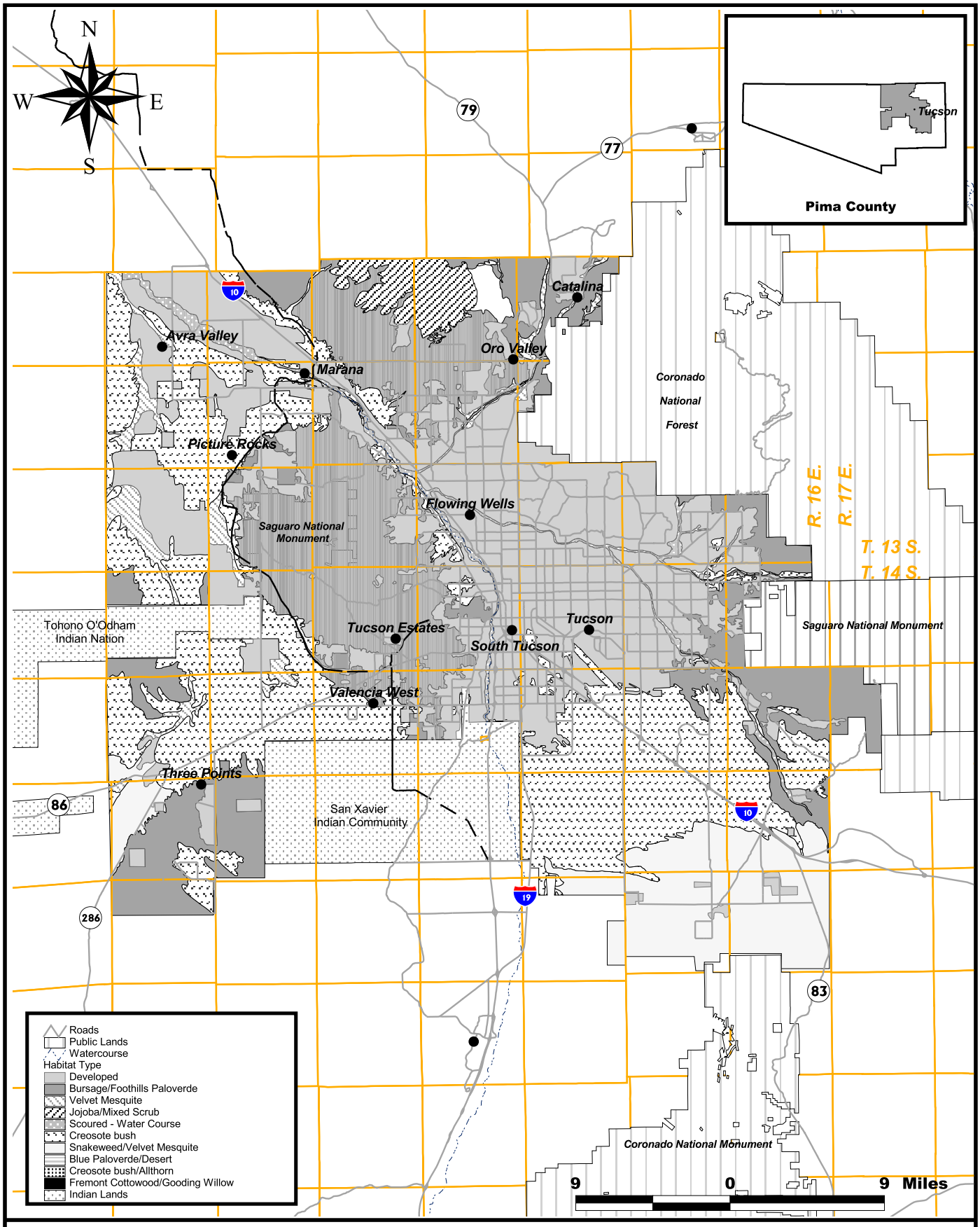
Impacts to Biological Resources

Under the No Action Alternative, urban growth within the City of Tucson MPA over the 50-year study period would result in loss of an estimated 48,454 acres of Sonoran desertscrub and associated wildlife resources. There may also be indirect impacts on wildlife occurring in the adjacent undeveloped habitat. Under the action alternatives, there is no difference in impacts from the No Action baseline. Construction of additional CAP treatment or delivery facilities does not appear likely at this time. Based on Tucson's final plans for taking the additional allocation, Reclamation would determine if additional environmental review is needed.

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The City of Tucson would be responsible for complying with the relevant provisions of the ESA as it permits and approves future urban growth.

The City of Tucson MPA is located within Pima County for which there are 16 T&E species listed by USFWS. Potentially suitable habitat only exists for cactus ferruginous pygmy-owl and the Pima pineapple cactus. There is no designated critical habitat for the Pima pineapple cactus and approximately 441 acres of potentially suitable habitat were identified. Also, approximately 233,558 acres of potentially suitable habitat for the cactus



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CAP Allocation Draft EIS
Habitat Zones
City of Tucson

June 2000

Figure No. L-M&I-58

ferruginous pygmy-owl were identified within the Tucson MPA. While there is no designated critical habitat for the Nichol's Turk's Head cactus, 100 acres of potentially suitable habitat were identified.

4. Water Resources

While the City has an extensive service area, most of the historical demands and groundwater pumping have occurred in a much more limited metropolitan area, generally located between the Tucson and Rincon Mountains. The demands in that metropolitan area have historically been met primarily by pumping groundwater from the underlying sedimentary rocks. This reliance on groundwater has resulted in declining groundwater levels over time, and there has been subsidence associated with these lower groundwater levels. The concentration of TDS in the underlying groundwater is generally less than 1,000 ppm, although there are pockets of groundwater with TDS in the range of 1,000 to 3,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-115, which shows the estimated groundwater level change for the period from 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. Groundwater conditions were estimated in the analysis for both the eastern and western part of the Tucson metropolitan area. Another area of particular interest for the City of Tucson is the well field in the southern part of Avra Valley. Three values are presented in Table L-M&I-109 for each alternative, representing groundwater levels for (in order) the western part of the Tucson metropolitan area, the eastern part of the Tucson metropolitan area, and the southern part of Avra Valley.

Under the No Action Alternative, groundwater levels would rise about 10 feet in the western metropolitan area and decline about 53 feet in the eastern metropolitan area. Those changes reflect both the direct use of a portion of Tucson's CAP water and the direct recharge of a portion of the available CAP water in the Santa Cruz Managed Recharge Project in the western metropolitan area. Groundwater levels would decline by about 153 feet in South Avra Valley, primarily in response to groundwater pumping by the City of Tucson well field in South Avra Valley. Substantial changes in groundwater quality would not be anticipated. However, there would be the potential for subsidence due to the lower groundwater levels in the eastern metropolitan area and particularly in the South Avra Valley.

Groundwater levels would be improved relative to the No Action Alternative in the Tucson metropolitan area under all of the action alternatives. Those improvements are largest for the Settlement Alternative and Non-Settlement Alternatives 1 and 3B, in which the City of Tucson would receive an additional allocation of CAP water. For Non-Settlement Alternatives 2 and 3A, the City of Tucson would not receive an additional

allocation of CAP water, and the groundwater levels would be similar to the No Action Alternative. The slight improvement in groundwater levels under those alternatives primarily results from changes in underflow due to higher groundwater levels south of the Tucson metropolitan area due to direct recharge.

In the South Avra Valley area, groundwater levels would only be slightly higher than under the No Action Alternative. The small improvements in groundwater levels would reflect impacts related to delivery of CAP water to the nearby Schuk Toak District of the Tohono O'odham Nation.

Substantial changes in groundwater quality would not be anticipated for any of the alternatives. There would be some potential for improvement of groundwater quality along the Santa Cruz River in the metropolitan Tucson area, due to direct recharge of CAP water which has better quality than some of the underlying groundwater. There would be the potential for subsidence under all alternatives in the eastern metropolitan area, and particularly in the South Avra Valley area.

Table L-M&I-115
CAP Allocation Draft EIS
City of Tucson –Groundwater Data Table

Alternative	**Tucson East***	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	10/-53/-153	--
Settlement Alternative	52/-27/-149	42/26/4
Non-Settlement Alternative 1	39/-30/-153	30/23/0
Non-Settlement Alternative 2	20/-50/-150	11/3/3
Non-Settlement Alternative 3A	20/-50/-150	11/3/3
Non-Settlement Alternative 3B	50/-27/-150	41/26/3

*****Values correspond to the Tucson West, Tucson East, and South Avra Valley sub-areas, respectively, as discussed in Appendix I.

** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, for providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. It should be noted that the increment of demand

met by the proposed CAP allocation is approximately 4.2 percent of the total year 2051 demand for the City of Tucson.

Table L-M&I-116
CAP Allocation Draft EIS
City of Tucson –Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	234[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	234[b]	CAGRD
Non-Settlement Alternative 3A	234[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.